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Medical Education in People's Republic of China

John A. D. Cooper, M.D., Ph.D., and Lin Yingang

Abstract—The three types of physicians being educated in the People's Republic of China—practitioners in traditional Chinese medicine, traditional Mongolian medicine, and western-type medicine—and the nation's medical schools are discussed. The country officially recognizes 117 health professions educational institutions—23 colleges of traditional Chinese medicine, 91 western-type medical schools, two schools of pharmacy, and one institution that trains pharmacy, medical, and hygienic inspectors. Eight of the 91 western-type schools, in addition to providing training in western-type medicine, also offer education in traditional Chinese medicine. Training in Mongolian medicine is offered by one of these eight western schools and by one other western school. No schools offer only Mongolian medicine education.

Three types of physicians are being educated in the People's Republic of China: practitioners of traditional Chinese medicine (zhongyi), traditional Mongolian medicine, and western-type medicine (xiyi).

Traditional Medical Schools

Traditional Chinese medicine goes back almost 50 centuries. It is based on the concepts of yin and yang, pairs of fluidly interacting opposites, and qi, or vital energy. These two concepts are related in Chinese medicine, which defines the harmonious and timely exchange of qi as constituting health. Five yin systems store the various forms of this vital energy in the body, and six yang systems assimilate and transfer it from place to place (1).

The aim of the traditional Chinese physician is to maintain this dynamic balance in the patient and to restore it when it has been disturbed. In assessing the patient's condition, Chinese medical practice makes use of a fourfold method of diagnostic observation (1). This includes: visual examination; listening to the patient's breathing and any other sounds; odors of breath, body, and excretions; medical history and present complaint; and touch, including the nature of the pulse. The principal therapeutic methods used to establish internal harmony in the patient are "the administration of drugs or herbs or through manipulation at the surface of the body [including acupuncture and moxibustion]" (1).

The 23 colleges of traditional Chinese medicine train physicians and pharmacists. Table 3 (appearing at the end of this article) shows the relationship between these institutions and governmental agencies; gives the total number of faculty members, professors, and associate professors; and lists the specialties that are

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taught. (All of the 23 colleges have "traditional Chinese medicine" in their titles.)

With the encouragement of the Ministry of Public Health, some western-type Chinese medical schools also train their students in traditional medicine techniques. More than 130,000 graduates in western medicine have studied traditional Chinese medicine, and 2,230 have received the title of physician-in-charge that designates those who use both techniques (2). Eight western-type medical schools also graduate students in traditional Chinese medicine and two in traditional Mongolian medicine.

Prior to the Liberation in 1949, there was great variation in the training of traditional practitioners. In 1955 the qualifications for these practitioners were formally defined, and their education and training are now carried out in medical colleges of traditional medicine (3).

The total number of students and the numbers who were admitted and graduated in the 1985–86 academic year in traditional Chinese medical schools are given in Table 1. Students enter from high school for a course of study lasting five or six years. The traditional method of teaching by preceptors was retained as far as possible in the medical school programs.

Of the 23 traditional Chinese medical schools, two are supported by the Ministry of Public Health, seven by the health bureau of a province, five by the higher education bureau of a province, one by the higher education bureau of a city, six by the educational bureau of a province, one by the educational bureau of a city, and one by the health bureau of an autonomous region.*

A total of 336,200 doctors were practicing traditional Chinese medicine in 1985,* up from 258,000 in 1979 (4). In the past the practice was largely by indigenous doctors; but beginning in 1956 it became a part of regular hospital care,* and by 1985 there were 1,455 hospitals or outpatient departments and most general hospitals had incorporated traditional medicine into their system of care. There were 102,390 traditional Chinese medicine hospital beds out of a total of about 2,487,000 beds in the country.*

TABLE 1

Total Enrollment and Number of Students Admitted and Graduating, People's Republic of China Medical Schools, 1985–86

Type of Progam	Total Enrolled	Admitted	Graduated
Traditional Chinese medicine	19,552	3,871	3,945
Western-type medicine	90,533	21,520	18,348
Traditional Mongolian medicine	518	200	84

Source: Ministry of Public Health, People's Republic of China.

Western-Type and Other Schools

Western-type medicine was introduced into China early in the 19th century through a dispensary established by British missionaries on Macao Island and the Canton Ophthalmic Hospital established by Peter Parker, an American medical missionary (5). Formal medical schools were established by missionaries from Europe and the United States during the 19th and early 20th centuries.

Ninety-one civilian western-type medical schools were in operation in 1986. As mentioned earlier, eight of these schools also graduate traditional Chinese medical physicians and two graduate traditional Mongolian medical physicians. All 91 schools are under the direction of and supported by a variety of governmental agencies: the Ministry of Health (11

* *Data provided by the Ministry of Public Health of the People's Republic of China.*

schools); the health bureau of a province (22) or a city (2); the higher education bureau of a province (16); the health bureau of an autonomous region (1); the higher education bureau of a city (1); the educational bureau of a province (19), city (1), or an autonomous region (8); the State Nationalities Affairs Commission (1); the Office of Overseas Chinese Affairs of the State Council (1); the National Non-ferrous Metal Industrial Corporation (1); and the ministries of railways (2), coal (1), metallurgical industry (1), communication (1), nuclear industry (1) and agriculture, animal husbandry, and fisheries (1).

The medical schools of ministries and agencies other than those related to health or education train physicians and other health professionals for their own programs. The School of Medical Inspection of Hubei Province, which trains pharmacy, medical, and hygienic inspectors, is under the health bureau of the province. The two independent pharmacy schools are under the Medicinal Administration Bureau. Thus, the People's Republic of China officially recognized 117 health professions educational institutions (Table 3).

One pharmacy school was established in 1936 and the other in 1948. Instead of creating additional pharmacy schools to meet increased needs, both western-type and traditional Chinese medical schools undertook the training of pharmacists.

In addition to the civilian institutions, four military medical schools (not shown in Table 3) under the Ministry of Defense prepare physicians for the armed forces.

Fourteen of the 91 civilian western-type medical schools were designated medical universities in 1985. Of the nine under the Ministry of Public Health, four (Zhongshan Medical University in Guangzhou, Shanghai Medical University, Beijing Medical University, and the West China Medical University) have been identified as "key" institutions and receive special funding from the ministry.

TABLE 2

Founding Dates of Medical Schools in the People's Republic of China

Date	Western-Type Medical Schools*	Traditional Chinese Medical Schools
≤1940	14	
1941–1950	12	
1951–1960	46	19
1961–1970	3	1
1971–1980	12	2
1981–1986	4	1

* Training in traditional Mongolian medicine is also offered by two western-type medicine schools. No schools offer only training and education in Mongolian medicine.

Source: Ministry of Public Health, People's Republic of China.

The oldest of the Chinese medical schools is the Zhongshan Medical University in Guangzhou (Canton). Fourteen western-type medical schools were established before 1940. Forty-six were opened in the decade of the 1950s at about the time of the Great Leap Forward when the government gave great attention to health issues. During this same decade the first 19 traditional Chinese medical schools were developed (Table 2).

The number of students enrolled and graduating from western-type medical schools in 1985–86 is given in Table 1. Students enter western-type medical schools on graduation from high school at about age 18. They usually apply to schools near their home, but some students do come from other towns. They are selected for admission largely on the basis of a national examination administered under the supervision of the Ministry of Education. Although applicants come from the upper part of their graduating class, medicine does not have the

prestige that it has in the United States, and the best students go into engineering because of the opportunities made available by efforts to strengthen and modernize the nation's industry. However, from observations made by the first author, the medical students are bright and energetic and appear to be deeply dedicated to a career of service to their country.

Medical students are required to live in dormitories provided by the college. There is no charge for tuition or rent, but the students are required to pay for their board (the equivalent of about $12 a month) and for some books. Although these costs seem low, they are a substantial sum in relationship to income in China. Scholarships are available for students who need financial assistance.

The curriculum of most western-type schools is five years in length and is based on the European system. During the first year, students take physics, chemistry, biology, higher mathematics, human anatomy, histology and embryology, and some social sciences. They begin a foreign language (usually English) and political philosophy courses that continue into the third year. In the second year, they have physiology, biochemistry, parasitology and pathology. In the third year, they take pathophysiology, microbiology, pharmacology, laboratory diagnosis, physical diagnosis, radiology, some traditional Chinese medicine, and public health.

During the fourth year, students have lectures in the clinical disciplines. In the fifth year, they are assigned to clinical clerkships, mainly in medicine, surgery, obstetrics/gynecology, and pediatrics. Some schools have a sixth year consisting of a rotating internship with 12-week assignments in the major clinical disciplines. Part of the time is spent in clinics and small hospitals in the city or country.

The Peking Union Medical College (PUMC), a special institution of excellent quality with an outstanding faculty, was opened in 1917 with the support of the Rockefeller Foundation and the China Medical Board. It is closely related to the Chinese Academy of Medical Sciences, whose programs are very similar to those of the National Institutes of Health in the United States. PUMC is largely devoted to the development of highly trained scientific personnel, and there is great competition by applicants from all parts of the country for a place in its small entering class of about 30 students. The medical school course is eight years in length. Two and a half years are spent in premedical education at the Beijing University, and the medical school segment of preclinical and clinical courses takes five and a half years. Throughout the curriculum, basic training in research is emphasized.

Although all of the medical schools are under the general supervision of the Ministry of Public Health, in recent years each institution has been given considerable latitude in designing its course of study. A standardized curriculum does not exist.

Postgraduate Pathways

On graduation from western-type medical schools, students receive a bachelor of medical sciences degree. On the basis of plans from the Ministry of Public Health and the students' performances in medical school and grades on an examination, they follow one of three paths. The faculty is permitted to select about 20 percent of the graduates for further training at the medical school.

One pathway is a three-year program that includes additional courses and a research project under a basic science or clinical faculty member leading to a master of medical sciences degree. During the training period, students in this program serve as teaching assistants for medical

student courses. Those with the master's degree may enter a residency program if they want to become a faculty member in a clinical discipline or continue their graduate work for a doctor of medical science degree.

All advanced degrees beyond the bachelor's are under the control of the Academic Degree Commission of the State Council, although for those in the medical sciences approval is usually *pro forma*. The State Council has not agreed to requests from medical colleges to give the Ph.D. or the M.D. degrees.

A second pathway is three years of residency training leading to qualifications as a specialist. The third pathway is for those graduates not chosen for further training. They are assigned by the Ministry of Labor and Personnel to clinics or small hospitals in the country, usually at a remote site.

Students work very hard to get into the 20 percent chosen for additional training. However, even if they are successful, they do not have complete freedom in making a career choice. They may have to select a program or a specialty of medicine that is not their first preference.

After completing advanced training, graduates are given appointments as lecturers. Those in the clinical disciplines become members of the staff of one of the teaching hospitals. If they are good enough, they may move through the ranks to become professors. Almost all of the graduates remain at the medical center in which they were educated and trained. Few of them move to another institution, in part because they usually grew up in the area and have close family ties and in part because of difficulties in finding accommodations in another city without relatives there.

The facilities in the four western-type medical universities and their teaching hospitals visited by the first author in 1985, although not elegant, are adequate for good educational programs. Student laboratories have modern equipment. The libraries provide resources for medical students and investigators, and some have links to the National Library of Medicine of the National Institutes of Health. The faculties have modest laboratories and equipment to carry out their research. However, as in most developing countries, problems are experienced with maintenance and repair of the equipment.

In 1985 China had 602,200 senior and 472,000 middle-level western-type physicians, about 970 people per physician, according to Ministry of Public Health data.

Conclusion

Medical education and medical care in China have made a remarkable recovery from the devastating effects of the Cultural Revolution. The high priorities being given to extending and improving medical care through the strengthening and expansion of medical education and biomedical research by Minister of Public Health Cui Yueli give much promise for continuing the development of resources and programs. Unless there are changes in the present direction, medicine in China will achieve equal footing with that in western countries.

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TABLE 3

Medical Schools, People's Republic of China, 1985–86

Province/School	Year Started	Responsible Agency	Teaching Staff			Medical Students			Graduate Students	Programs
			Total	Prof.	Assoc. Prof.	Admitted	Graduated	Total Enrolled		
Anhui										
Anhui College of Traditional Chinese Medicine, Hefei	1958	Health Bureau of Province	282	2	15	100	209	646	13	Traditional Chinese medicine and pharmacy, acupuncture and massage, pharmacy
Anhui Medical College, Hefei	1949	Health Bureau of Province	401	13	49	310	292	1,435	61	Medicine, stomatology, public health, health management
Bengbu Medical College, Bengbu	1958	Health Bureau of Province	259	6	18	276	341	1,264	17	Medicine, medical inspection, nursing
Wannan Medical College, Wuhu	1958	Health Bureau of Province	219	1	18	255	202	1,056	25	Medicine
Beijing										
Beijing College of Traditional Chinese Medicine, Beijing	1956	Ministry of Health	315	4	41	121	117	600	134	Traditional Chinese medicine and pharmacy, acupuncture and massage, nursing
Beijing Medical University, Beijing	1912	Ministry of Health	763	46	174	220	—	1,169	563	Medicine, preclinical medicine, stomatology, public health, pharmacy, pharmaceutical chemistry, chemistry, nursing, experimental technology
Capital Medical College, Beijing	1960	Health Bureau of City	301	3	29	261	139	1,108	144	Medicine, pediatrics, stomatology
Peking Union Medical College, Beijing	1917	Ministry of Health	105	5	27	30	—	209	576	Medicine, nursing, experimental technology
Fujian										
Fujian College of Traditional Chinese Medicine, Fuzhou	1958	Higher Education Bureau of Province	230	5	10	152	150	674	6	Traditional Chinese medicine and pharmacy, acupuncture and massage, traditional Chinese orthopedics

TABLE 3—Continued

Province/School	Year Started	Responsible Agency	Teaching Staff			Medical Students			Graduate Students	Programs
			Total	Prof.	Assoc. Prof.	Admitted	Graduated	Total Enrolled		
Fujian Medical College, Fuzhou	1937	Higher Education Bureau of Province	365	8	22	404	316	1,783	42	Medicine, stomatology, public health, medical inspection
Gansu										
Gansu College of Traditional Chinese Medicine, Lanzhou	1978	Health Bureau of Province	123	2	1	104	112	513	—	Traditional Chinese medicine and pharmacy, acupuncture
Lanzhou Medical College, Lanzhou	1933	Health Bureau of Province	433	6	83	256	303	1,379	74	Medicine, stomatology, public health, pharmacy
The Department of Medicine of North-West College of Nationalities, Lanzhou	1958	State Nationalities Affairs Commission	44	—	—	36	30	137	—	Medicine
Guangdong										
Guangdong College of Medicine and Pharmacy, Guangzhou	1978	Higher Education Bureau of Province	299	1	17	100	29	264	—	Medicine, public health, pharmacy
Guangzhou College of Traditional Chinese Medicine, Guangzhou	1956	Ministry of Health	467	8	42	200	242	1,002	81	Traditional Chinese medicine and pharmacy, acupuncture
Guangzhou Medical College, Guangzhou	1958	Higher Education Bureau of Province	343	3	26	342	198	1,306	—	Medicine, radiology
Medical College of Jinan University, Guangzhou	1978	Office of Overseas Chinese Affairs of State Council	216	12	56	118	50	564	80	Medicine, stomatology
Medical College of Shantou University, Shantou	1958	Higher Education Bureau of Province	238	1	14	111	102	377	—	Medicine
Medical Department of Hainan University, Haikou	1952	Higher Education Bureau of Province	201	—	8	151	149	495	—	Medicine

Zhanjiang Medical College, Zhanjiang	1958	Higher Education Bureau of Province	237	3	20	243	199	1,121	7	Medicine, experimental technology
Zhongshan Medical University, Guangzhou	1866	Ministry of Health	688	37	131	349	—	2,062	389	Medicine, stomatology, forensic medicine, radiomedicine, anesthesiology, public health, nursing, clinical nutrition
Guangxi										
Guangxi College of Traditional Chinese Medicine, Nanning	1956	Education Bureau of Autonomous Region	299	3	8	95	98	737	6	Traditional Chinese medicine and pharmacy, acupuncture
Guangxi Medical College, Nanning	1934	Education Bureau of Autonomous Region	444	18	51	334	312	1,492	101	Medicine, stomatology, public health
Guangxi Youjiang Medical College of Nationalities, Baise	1958	Education Bureau of Autonomous Region	135	—	4	206	97	608	—	Medicine
Guilin School of Medicine, Guilin	1958	Education Bureau of Autonomous Region	149	—	—	153	97	361	—	Medicine
Guizhou										
Guiyang College of Traditional Chinese Medicine, Guiyang	1965	Education Bureau of Province	294	2	25	160	202	798	19	Traditional Chinese medicine and pharmacy, traditional Chinese orthopedics, acupuncture
Guiyang Medical College, Guiyang	1938	Education Bureau of Province	383	10	44	199	242	1,119	35	Medicine, pharmacy, public health
Zunyi Medical College, Zunyi	1949	Education Bureau of Province	320	—	12	160	226	714	16	Medicine, stomatology

TABLE 3—Continued

Province/School	Year Started	Responsible Agency	Teaching Staff			Medical Students			Graduate Students	Programs
			Total	Prof.	Assoc. Prof.	Admitted	Graduated	Total Enrolled		
Hebei										
Chengde Medical College, Chengde	1949	Education Bureau of Province	183	—	11	264* 41†	225* 41†	789* 123†	—	Medicine, traditional Chinese medicine, nursing
Hebei College of Traditional Chinese Medicine	1982	Education Bureau of Province	181	1	17	150	148	622	—	Traditional Chinese medicine
Hebei Medical College, Shijiazhuang	1970	Education Bureau of Province	578	16	138	404	370	1,968	86	Medicine, stomatology, pharmacy, public health
Huabei Medical College for the Coal Industry, Tangshan	1958	Ministry of Coal Industry	280	2	23	239	120	878	6	Medicine, public health
Zhangjiakou Medical College, Zhangjiakou	1949	Education Bureau of Province	183	—	11	211* 51†	200* 51†	690* 173†	—	Medicine, traditional Chinese medicine, medical inspection
Heilongjiang										
Harbin Medical University, Harbin	1949	Higher Education Bureau of Province	525	20	134	576	312	1,775	260	Medicine, stomatology, public health, biomedical engineering
Heilongjiang College of Traditional Chinese Medicine, Harbin	1959	Higher Education Bureau of Province	304	3	29	128	201	786	90	Traditional Chinese medicine and pharmacy, traditional Chinese orthopedics, acupuncture
Jiamusi Medical College, Jiamusi	1958	Higher Education Bureau of Province	238	2	27	178	146	892	35	Medicine, stomatology, pharmacy, pharmaceutics
Mudanjiang School of Medicine, Mudanjiang	1958	Health Bureau of Province	100	—	5	128	105	514	—	Medicine, radiology, anesthesiology
Qiqihar School of Medicine, Qiqihar	1978	Health Bureau of Province	100	—	9	117	107	326	—	Medicine, maternal and child hygiene, neurology, psychiatry

Henan										
Henan College of Traditional Chinese Medicine, Zhengzhou	1958	Education Bureau of Province	334	—	9	264	247	1,312	23	Traditional Chinese medicine and pharmacy, acupuncture
Henan Medical University, Zhengzhou	1953	Education Bureau of Province	505	17	94	359	421	2,013	141	Medicine, stomatology, pediatrics, public health
Kaifeng School of Medicine, Kaifeng	1958	Education Bureau of Province	187	—	2	223	219	642	—	Medicine, pharmacy
Luoyang School of Medicine, Luoyang	1958	Education Bureau of Province	178	—	—	340	353	1,010	—	Medicine, forensic medicine
Xinxiang Medical College, Jixian	1958	Education Bureau of Province	224	—	14	322	363	935	—	Medicine, pediatrics
Hubei										
Enshi School of Medicine, Enshi	1958	Education Bureau of Province	123	—	8	120* 40†	102* —	285* 80†	—	Medicine, traditional Chinese medicine
Hubei College of Traditional Chinese Medicine, Wuhan	1958	Education Bureau of Province	304	3	10	171	160	946	37	Traditional Chinese medicine and pharmacy, acupuncture
Hubei Medical College, Wuhan	1943	Education Bureau of Province	431	21	77	320	219	1,245	165	Medicine, stomatology, pediatrics, family planning management
School of Medical Inspection of Hubei Province, Wuhan	1984	Health Bureau of Province	58	—	1	—	—	—	—	Pharmacy, medical inspection, hygienic inspection
Tongji Medical University, Wuhan	1951	Ministry of Health	741	67	148	208	309	1,196	499	Medicine, pediatrics, forensic medicine, public health, environmental medicine, pharmacy, maternal and child hygiene, radiology
Wuhan School of Medicine for the Metallurgical Industry, Wuhan	1965	Ministry of Metallurgical Industry	160	—	4	172	102	544	—	Medicine, public health
Yichang School of Medicine, Yichang	1958	Education Bureau of Province	152	—	14	164* 49†	87* 29†	450* 92†	— —	Medicine, traditional Chinese medicine, maternal and child hygiene, radiology

TABLE 3—*Continued*

Province/School	Year Started	Responsible Agency	Teaching Staff			Medical Students			Graduate Students	Programs
			Total	Prof.	Assoc. Prof.	Admitted	Graduated	Total Enrolled		
Hunan										
Hengyang Medical College, Hengyang	1958	Education Bureau of Province	326	1	17	280	276	1,446	—	Medicine, ophthalmology, E.N.T.
Hunan College of Traditional Chinese Medicine, Changsha	1960	Education Bureau of Province	317	2	16	168	206	1,008	76	Traditional Chinese medicine and pharmacy, acupuncture
Hunan Medical College, Changsha	1914	Ministry of Health	622	34	105	402	364	1,743	300	Medicine, public health, medical inspection
Inner Mongolia Autonomous Region										
Baotou Medical College, Baotou	1958	Education Bureau of Autonomous Region	275	—	11	115	126	375	—	Medicine, public health
Inner Mongolia Medical College, Huhhot	1956	Education Bureau of Autonomous Region	508	14	47	242* 43† 120‡	239* 43† 43‡	1,253* 214† 196‡	30	Medicine, pharmacy, traditional Chinese medicine, Mongolian medicine
Inner Mongolia Medical College of Nationalities, Tongliao	1978	Education Bureau of Autonomous Region	171	1	3	135* 80‡	86* 41‡	342* 322‡	—	Medicine, Mongolian medicine
Jiangsu										
Nanjing College of Traditional Chinese Medicine, Nanjing	1958	Higher Education Bureau of Province	306	—	13	229	122	832	98	Traditional Chinese medicine and pharmacy, acupuncture and massage
Nanjing Medical College, Nanjing	1970	Higher Education Bureau of Province	560	17	93	352	191	1,306	182	Medicine, stomatology, pediatrics, nursing, public health

Nanjing Pharmacy College, Nanjing	1936	Medicinal Administration Bureau	273	2	12	—	—	—	93	Pharmacy, pharmacology, chemical pharmaceutics, biochemical pharmaceutics, traditional Chinese pharmacy
Nanjing Railway Medical College, Nanjing	1958	Ministry of Railways	371	6	35	250	301	1,211	52	Medicine, public health
Nantong Medical College, Nantong	1958	Ministry of Communication	270	—	40	265	210	1,152	56	Medicine, seafaring medicine
Suzhou Medical College, Suzhou	1957	Ministry of Nuclear Industry	515	9	67	262	237	1,119	79	Medicine, radio-medicine
Xuzhou Medical College, Xuzhou	1958	Higher Education Bureau of Province	225	3	20	302	155	1,270	5	Medicine
Yangzhou Medical College, Yangzhou	1979	Higher Education Bureau of Province	187	—	6	162	—	597	—	Medicine, uterology, traditional Chinese medicine
Zhenjiang Medical College, Zhenjiang	1980	Higher Education Bureau of Province	177	1	11	154	—	611	—	Medicine, medical inspection
Jiangxi										
Gannan School of Medicine, Ganzhou	1958	Health Bureau of Province	149	1	15	208	204	636	—	Medicine, maternal hygiene
Jiangxi College of Traditional Chinese Medicine, Nanchang	1958	Health Bureau of Province	313	3	24	180	184	854	8	Traditional Chinese medicine and pharmacy, pharmacy
Jiangxi Medical College, Nanchang	1952	Health Bureau of Province	542	13	94	380	535	2,333	52	Medicine, stomatology, pediatrics, public health
Jilin										
Bethune Medical University, Changchun	1938	Ministry of Health	568	23	202	279	407	1,589	316	Medicine, stomatology, pediatrics, radio-medicine, public health, medical library science, environmental medicine, nutrition and food hygienic inspection

TABLE 3—*Continued*

Province/School	Year Started	Responsible Agency	Teaching Staff			Medical Students			Graduate Students	Programs
			Total	Prof.	Assoc. Prof.	Admitted	Graduated	Total Enrolled		
Changchun College of Traditional Chinese Medicine, Changchun	1958	Health Bureau of Province	192	1	10	125	42	595	14	Traditional Chinese medicine and pharmacy, acupuncture
Jilin Medical College, Jilin	1951	Health Bureau of Province	317	3	25	116	210	798	2	Medicine, medical inspection
Yanbian Medical College, Yanji	1948	Health Bureau of Province	225	6	40	201	121	776	20	Medicine, pharmacy
Liaoning										
China Medical University, Shenyang	1931	Ministry of Health	404	9	67	390	310	1,573	320	Medicine, stomatology, pediatrics, forensic medicine, public health, nursing
Dalian Medical College, Dalian	1947	Health Bureau of Province	316	15	84	235	104	801	59	Medicine, stomatology, public health
Jinzhou Medical College, Jinzhou	1946	Health Bureau of Province	240	1	31	235	302	1,350	25	Medicine
Liaoning College of Traditional Chinese Medicine, Shenyang	1958	Health Bureau of Province	358	3	24	118	90	698	25	Traditional Chinese medicine and pharmacy, acupuncture, traditional Chinese orthopedics
Shenyang School of Medicine, Shenyang	1978	Health Bureau of Province	174	—	2	152	77	400	—	Medicine, public health
Shenyang Pharmacy College, Shenyang	1948	Medicinal Administration Bureau	300	3	40	—	—	—	73	Basal pharmacy, pharmacy, pharmaceutics, microbial production, traditional Chinese pharmacy
Ningxia										
Ningxia Medical College, Yinchuan	1958	Health Bureau of Autonomous Region	195	1	14	165	162	662	24	Medicine, public health, experimental technology
Qinghai										
Qinghai Medical College, Xining	1958	Education Bureau of Province	201	1	14	145* 31†	148* —	569* 134†	16	Medicine, traditional Chinese medicine, plague prevention

Shandong										
Binzhou Medical College, Binzhou	1983	Health Bureau of Province	248	1	14	237	255	1,082	—	Medicine
Changwei Medical College, Weifang	1950	Health Bureau of Province	303	—	19	306	296	1,439	—	Medicine
Heze School of Medicine, Heze	1958	Health Bureau of Province	126	—	2	265	80	621	—	Medicine
Jining School of Medicine, Jining	1974	Health Bureau of Province	178	—	10	327	304	936	—	Medicine, public health
Qingdao Medical College, Qingdao	1956	Health Bureau of Province	398	12	41	244	248	1,132	39	Medicine, pediatrics, medical inspection radiology
Shandong College of Traditional Chinese Medicine, Jinan	1958	Health Bureau of Province	328	4	13	121	159	860	63	Traditional Chinese medicine and pharmacy, acupuncture
Shandong Medical University, Jinan	1948	Ministry of Health	718	17	82	292	312	1,539	214	Medicine, stomatology, public health, pharmacy, nursing
Taishan Medical College, Taian	1983	Health Bureau of Province	241	—	8	221	121	1,041	—	Medicine, radiology
Yishui School of Medicine, Yishui	1974	Health Bureau of Province	115	—	1	246	201	650	—	Medicine
Shanghai										
Shanghai College of Traditional Chinese Medicine, Shanghai	1956	Education Bureau of City	299	10	37	157	123	637	136	Traditional Chinese medicine and pharmacy, acupuncture and massage
Shanghai Medical University, Shanghai	1926	Ministry of Health	798	50	92	279	244	1,156	469	Medicine, preclinical medicine, medical engineering, forensic medicine, medical inspection, public health, pharmacy, pharmacology, pharmaceutics, nursing, public health management
Shanghai Railway Medical College, Shanghai	1978	Ministry of Railways	237	—	17	166	—	617	—	Medicine, stomatology
Shanghai Second Medical University, Shanghai	1953	Education Bureau of City	710	55	108	544	464	2,075	288	Medicine, stomatology, pediatrics, medical inspection, medical engineering

TABLE 3—*Continued*

Province/School	Year Started	Responsible Agency	Teaching Staff			Medical Students			Graduate Students	Programs
			Total	Prof.	Assoc. Prof.	Admitted	Graduated	Total Enrolled		
Shanxi										
Datong School of Medicine, Datong	1958	Education Bureau of Province	160	—	—	203* 99†	208* 100†	553* 304†	—	Medicine, traditional Chinese medicine
Shanxi Medical College, Taiyuan	1950	Education Bureau of Province	679	11	92	245	245	1,230	110	Medicine, pediatrics, forensic medicine, public health, stomatology, pharmacy
South-East Shanxi School of Medicine, Changzhi	1958	Education Bureau of Province	198	—	5	219	259	585	—	Medicine, nursing, uterology
Shaanxi										
Huashan School of Medicine for the Metallurgical Industry, Huayin	1960	National Nonferrous Metal Industrial Corporation	187	—	4	89	68	409	—	Medicine, radio-medicine
Shaanxi College of Traditional Chinese Medicine, Xianyang	1958	Higher Education Bureau of Province	271	—	11	168	170	708	52	Traditional Chinese medicine and pharmacy, acupuncture
Xian Medical University, Xian	1937	Ministry of Health	585	15	93	273	354	1,827	244	Medicine, stomatology, pharmacy, public health, forensic medicine
Yanan Medical College, Yanan	1978	Higher Education Bureau of Province	95	—	3	80	39	241	—	Medicine
Sichuan										
Chengdu College of Traditional Chinese Medicine, Chengdu	1956	Higher Education Bureau of Province	324	1	30	171	190	1,041	54	Traditional Chinese medicine and pharmacy, acupuncture
Chongqing Medical University, Chongqing	1956	Higher Education Bureau of Province	642	12	103	317	378	1,559	121	Medicine, pediatrics, medical inspection, family planning management

Luzhou Medical College, Luzhou	1958	Higher Education Bureau of Province	346	1	23	275* 60†	376* 60†	1,528* 312†	—	Medicine, traditional Chinese medicine
North Sichuan Medical College, Nanchong	1964	Higher Education Bureau of Province	223	—	11	289	278	787	—	Medicine, radiology
West China Medical University, Chengdu	1910	Ministry of Health	887	43	192	242	271	1,114	490	Medicine, stomatology, forensic medicine, public health, hygienic inspection, nutrition hygiene, pharmacy, pharmaceutical chemistry, experimental technology
Tianjin										
Tianjin College of Traditional Chinese Medicine, Tianjin	1978	Higher Education Bureau of City	274	1	29	65	126	500	51	Traditional Chinese medicine and pharmacy, acupuncture, traditional Chinese orthopedics, traditional Chinese traumatology
Tianjin Medical College, Tianjin	1952	Higher Education Bureau of City	593	22	91	259	286	1,306	192	Medicine, stomatology, nursing, public health
Tianjin Second Medical College, Tianjin	1978	Health Bureau of City	307	—	7	60	52	150	—	Medicine, radiology, medical inspection, pharmacy
Tibet Autonomous Region										
The Department of Medicine of Tibet College of Nationalities, Xianyang, Shanxi	1983	Education Bureau of Autonomous Region	24	—	2	40	42	81	—	Medicine
Xinjiang Uygur Autonomous Region										
Shihezi Medical College, Shihezi	1958	Ministry of Agriculture, Animal Husbandry and Fishery	141	—	3	208	151	786	—	Medicine, pharmacy

TABLE 3—*Continued*

Province/School	Year Started	Responsible Agency	Teaching Staff			Medical Students			Graduate Students	Programs
			Total	Prof.	Assoc. Prof.	Admitted	Graduated	Total Enrolled		
Xinjiang Medical College, Urumqi	1955	Education Bureau of Autonomous Region	384	16	40	296	213	1,165	58	Medicine, preclinical medicine, public health, pharmacy, plague prevention
Yunnan										
Dali Medical College, Dali	1982	Education Bureau of Province	119	—	—	95	—	392	--	Medicine
Kunming Medical College, Kunming	1956	Education Bureau of Province	606	22	37	391	297	1,768	84	Medicine, stomatology, public health, forensic medicine
Yunnan College of Traditional Chinese Medicine, Kunming	1956	Education Bureau of Province	193	—	6	130	143	830	15	Traditional Chinese medicine and pharmacy, acupuncture and massage
Zhejiang										
Wenzhou Medical College, Wenzhou	1958	Health Bureau of Province	276	1	16	216	149	1,002	24	Medicine, pediatrics
Zhejiang College of Traditional Chinese Medicine, Hangzhou	1959	Health Bureau of Province	199	3	14	180	180	921	10	Traditional Chinese medicine, acupuncture
Zhejiang Medical University, Hangzhou	1912	Health Bureau of Province	564	16	99	310	308	1,675	165	Medicine, stomatology, pharmacy, clinical nutrition, medical engineering

* Western medicine students.
† Traditional Chinese medicine students.
‡ Mongolian medicine students.

Relationship of Scholarships and Indebtedness To Medical Students' Career Plans

Thomas H. Dial, Ph.D., and Paul R. Elliott, Ph.D.

Abstract—Discriminant functions analyses of data from the 1983 survey of senior medical students by the Association of American Medical Colleges showed that the effects of scholarships must be taken into account when assessing the influence of indebtedness on medical students' career choices. Receipt of a federal scholarship, type of medical school attended (public or private), marital status, sex, and receipt of a nonfederal scholarship were found to be more powerful than indebtedness as predictors of whether the students preferred primary care or nonprimary care specialties. Receipt of a federal scholarship, type of school attended, and sex were found to be more powerful than indebtedness as predictors of whether the students preferred private clinical practice, salaried clinical practice in a hospital or clinic, salaried clinical practice in a public agency, or a nonclinical career. Indebtedness was found not to be a predictor of willingness to locate in a socioeconomically deprived area.

In spite of a growth in the supply of physicians that is expected to continue into the next decade, problems with the availability of health care remain because of the distribution of physicians geographically and among specialties (1, 2). Moreover, a shortage of minority physicians exacerbates the distribution problem because minority physicians tend to be more inclined than nonminority physicians to practice in medically underserved areas (3).

Because of recent and continuing reductions in scholarships and other forms of financial aid by the federal government, accompanied by increased tuition costs, medical students have had to borrow more heavily than previously to meet their educational expenses. The growing financial burden faced by future medical students, particularly those from minority and low-income families, may contribute to continuing physician distribution problems. The prospect of large debt may discourage minority students from seeking medical careers and thus delay improvement in the availability of health care among the poor and others who live in underserved areas.

At least two hypotheses have been put forward to explain how indebtedness might influence medical students' specialty choices: first, that high indebtedness tends to motivate students to choose higher-paying specialties (4, 5) and, second, that indebtedness tends to motivate

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them to select specialties requiring minimum training periods (6–9).

Previous studies have found that medical students' general background characteristics were stronger predictors than indebtedness of specialty choice and of interest in practicing in underserved areas (10, 11). The effect of indebtedness on specialty choice was found to depend on whether the indebtedness was incurred from a subsidized or nonsubsidized educational loan program (12).

The authors' purpose in the present study was to examine the effects and interrelationships of debt and other financial and demographic factors that influenced the career choices of 1983 medical school graduates. The specific career choices examined were the decision to become certified in either a primary care specialty or a nonprimary care specialty, the decision to establish a traditional private practice or enter some other kind of medical career, and a willingness to locate in a socioeconomically deprived area. The authors evaluated the influence of the type of scholarship or grant (if any) received by students during medical school and the influences of indebtedness and other relevant factors on the students' career plans. Data limitations made it impossible to assess separately the effects of indebtedness incurred from different loan programs. No previously published study has investigated the effects of receiving scholarships. However, unless information on receiving scholarships is included in analyses of career plans, the effects of scholarships may be mistakenly attributed to low indebtedness or to other correlates of having received a scholarship.

Methods

Each year the Association of American Medical Colleges conducts a survey of all senior medical students enrolled in its member institutions. Data for this paper were obtained from the 1983 survey. The survey solicits information from medical school seniors under four main headings: graduate medical education plans, career plans, medical school experiences and curriculum, and demographic and financial information.

Students at all 124 accredited U.S. medical schools granting M.D. degrees participated in the 1983 survey. The overall response rate was 66.3 percent. The response rates did not vary substantially by sex or between public and private medical schools, but there were sizable differences by ethnic self-description. Members of underrepresented minority groups were almost one-third less likely and members of other minority groups about one-tenth less likely to respond to the survey than were nonminority students. "Underrepresented" minority groups are those whose numbers among U.S. medical students are proportionally smaller than their numbers in the population as a whole. "Other" minority groups are those that are not underrepresented among medical students.

The available evidence suggests that data from the graduation survey are highly reliable and valid. For example, the mean amount of debt reported by the students on the 1983 survey ($23,815) differed by only 0.7 percent from the mean indebtedness of senior students ($23,647) reported by financial aid officers on the 1983 survey conducted by the Liaison Committee on Medical Education.

VARIABLES

The demographic and background variables examined were sex, ethnic self-description, marital status, number of dependents, receipt of a scholarship, type of

scholarship, and whether the student attended a public or private medical school.

Ethnic self-description was sorted into three categories: underrepresented minorities, other minorities, and nonminority respondents. Minority groups that are underrepresented in medical schools are blacks, American Indians, Mexican-Americans (Chicanos), and U.S. mainland residents of Puerto Rican heritage. "Other" minorities (that is, those who are not underrepresented among medical students) are Commonwealth Puerto Ricans, other Hispanics, Asian-Americans, and Pacific Islanders.

The survey questionnaire asked respondents to indicate which (if any) of seven types of scholarships they received: Armed Forces Health Professions Scholarship Program, National Health Service Corps Scholarship Program, state-funded programs, school-awarded programs, foundation-funded programs, local charitable organizations, or other. These types were classified into two categories: federally funded (Armed Forces Health Professions Program and National Health Service Corps scholarships) and all others (those funded by states, schools, foundations, local charitable organizations, and other sources).

Marital status was defined by six categories in the questionnaire: never married, separated, divorced, widowed, engaged, or married. These categories were combined into three: married; separated, widowed, or divorced; and all others.

For the analysis of the effects of indebtedness on career plans, the outcome variables were defined and measured as follows:

Preferred specialty was defined as either a primary care or nonprimary care specialty. The Health Professions Educational Assistance Act of 1976 (P.L. 94-484) identifies the primary care specialties as family practice, general internal medicine, and general pediatrics. All other specialties, including the subspecialties of internal medicine and pediatrics, were defined in the present paper as nonprimary care specialties.

To determine the students' career plans, the questionnaire asked for the preferred practice setting (if the student planned to enter clinical practice) and preferred type of career activity and asked whether the respondent would consider locating in a socioeconomically deprived area.

Data on the preferred career activity were taken from a question that asked the students to designate their first, second, and third choices from the following list of activities: full-time academic faculty appointment; salaried research scientist; private clinical practice alone, with one partner, or in a group; salaried clinical practice in a hospital, a clinic, or a government agency; or administration with no practice. Only the respondent's first choice from this list was used as a variable in the present analysis. For this paper, the students' preferred career activities were arranged into four categories: private clinical practice; salaried clinical practice in a clinic or hospital; salaried clinical practice in a state or federal agency; and academic, research, or administrative activities. This reclassification was prompted by the authors' recognition that the respondents who planned to be employed by government agencies differed in important ways from those who planned to practice in hospitals and nongovernment clinics.

STATISTICAL METHODS

A series of discriminant functions analyses were used to test the power of indebtedness and other student and school

characteristics (the predictor or discriminating variables) to discriminate among the groups of graduates who expressed different career preferences (the predicted or grouping variables). A discriminant function is, as the name implies, a mathematical function; it has no concrete interpretation or one-to-one correspondence with any single variable. The function has an empirically derived value, which is jointly determined by all the discriminating variables, for each individual in the sample. The average value of the function varies (more or less, depending on the success of the analysis) from one outcome category to another. In other words, the function mathematically discriminates among outcome categories; hence, the name.

The maximum number of discriminant functions that can be computed for any set of variables is equal to one less than the number of categories defined by the grouping variable. Thus, in the simple case where the grouping variable divides the sample into two categories (for instance, those preferring primary care specialties and those preferring nonprimary care specialties), only one function is computed, and the interpretation is generally quite straightforward. When the grouping variable divides the sample into more than two categories (as, for instance, in the analysis of career activity preferences), the interpretation is more complex.

A complete interpretation of the results of a discriminant analysis involves, first, assessment of the relative contribution of each discriminating variable to the total discriminating power of the function or set of functions and, second, assessment of the correlation of each function with each outcome category. The present study is primarily concerned with the first of these two assessments; therefore, that aspect of the interpretation is emphasized in the findings that follow.

Levels of statistical significance are not reported here because the data were taken from a survey of the entire population of 1983 U.S. medical school seniors rather than from a sample. If the respondents were assumed to be a random sample comprising approximately two-thirds of the total population, tests of statistical significance could be performed using a finite population correction factor. With very large samples, however, the confidence intervals around sample statistics become quite small. Given a sample size of more than 10,000 and the further enhancement of the finite population correction factor, the probability values for all statistics produced by discriminant analysis would be smaller than .001. Under these circumstances, it becomes possible to dispense with discussions of statistical significance and proceed directly to the question of the findings' practical importance (for which, regrettably, statistical significance is sometimes mistaken).

The "discriminant" procedure of the Statistical Package for the Social Sciences (13) was used. The analysis was done stepwise by using the minimum residual method. Under these specifications, the program first selects from the list of discriminating variables the one that, on the basis of *a priori* statistical criteria, appears to be the most powerful discriminator. This variable is entered into the equation(s) first. Of the remaining variables, the one that accounts for the maximum residual variance is added next, and so on. If at any point in the process the total discriminating power of the equation can be increased by removing a variable, this is done. At the end of the sequence, a set of standardized canonical discriminant function coefficients is produced. Comparison of the relative magnitudes of these

coefficients reveals the relative contribution of each variable to the total discriminating power of each function. Usually, the rank ordering by absolute value of the coefficients for the first function corresponds approximately to the sequence in which the variables were added to the equation.

The career preferences used as grouping variables were specialty choice, preferred career activity, and willingness to locate in a socioeconomically deprived area. In order to obtain interpretable results, it was necessary to translate the discriminating variables except for indebtedness and number of dependents into binary variables (that is, variables having values of either zero or one). The resulting variables were named and coded as follows: "female" (1 if female; zero if male); "underrepresented minority" (1 if member of an underrepresented minority group; zero otherwise); "other minority" (1 if member of a non-underrepresented minority group; zero otherwise); "federal scholarship" (1 if received a federal scholarship; zero otherwise); "nonfederal scholarship" (1 if received a nonfederal scholarship; zero otherwise); "private school" (1 if attended a private medical school; zero otherwise); "married" (1 if married, zero otherwise); and "separated/widowed/divorced" (1 if separated, widowed, or divorced; zero otherwise).

Findings

The relationship between receipt of a scholarship and indebtedness varied a great deal from one type of scholarship to another. Federal scholarship recipients were more likely than nonrecipients (21.3 percent as compared with 17 percent) to report that they had no debt. Only 4 percent of nonfederal scholarship recipients said they had no debt.

Indebted recipients of federal scholarships reported mean debts of $14,537 (S.D. = $11,454), which was $7,663 less than the mean indebtedness of those who received no scholarships ($22,200; S.D. = $13,051). Indebted recipients of nonfederal scholarships had a mean indebtedness of $28,685 (S.D. = $14,353), which was $6,485 higher than that of nonrecipients. The latter difference occurs because nonfederal scholarships tend to be need-based and, therefore, to be awarded to students who must also borrow and because these scholarships are somewhat more prevalent at private schools than at public schools.

A total of 8,667 responses was used in the discriminant analysis of the students' preferences for primary care versus nonprimary care specialties. Six of the 10 discriminating variables were entered into the equation in the following sequence: federal scholarship, private school, married, female, nonfederal scholarship, and total educational indebtedness. The other four discriminating variables—underrepresented minority, other minority, separated/widowed/divorced, and number of dependents—failed to meet the minimum statistical criteria for inclusion in the equation.

The standardized canonical discriminant function coefficients from this analysis of specialty preference were: for federal scholarship, .71; for private school, −.59; for married, .32; for female, .31; for nonfederal scholarship, .22; and for total debt, −.11. These findings show that receipt of a federal scholarship is the most powerful discriminating variable associated with the selection of a primary care specialty. Attendance at a private medical school was strongly associated with selection of a nonprimary care specialty. Sex and marital status were moderately powerful discriminating variables; women tend more than men and

married students more than unmarried students to prefer primary care specialties. Indebtedness was evidently a less powerful discriminating variable than any of the foregoing, but large debts were somewhat associated with a tendency to prefer nonprimary care specialties.

The standardized canonical discriminant function coefficients for the analysis of preferred career activity are presented in Table 1. The number of responses used in this analysis of preferred career activity was 9,445. Nine of the 10 discriminating variables were entered into the equations in the following sequence: federal scholarship; private school; female; total educational indebtedness; other (that is, not underrepresented) minority; nonfederal scholarship; married; number of dependents; and underrepresented minority. Separated/widowed/divorced failed to meet the minimum statistical criteria for inclusion in the equations.

Indebtedness evidently was a more powerful predictor of preferred career activity than of specialty preference and willingness to locate in a deprived area. Its power as a discriminating variable was, however, again exceeded by the variables of receipt of a federal scholarship, attendance at a private medical school, and sex. Receipt of a federal scholarship was strongly associated with the expectation of being employed by a government agency. Attending a private school was associated with plans for an academic, research, or administrative career, and being a woman was associated with the expectation of salaried practice in a hospital or clinic. High indebtedness tended to be associated with the intent to enter academia, research, or administration, a

TABLE 1

Standardized Canonical Discriminant Function Coefficients (Showing the Relative Contributions of Selected Variables to Three Discriminant Functions) and Values of the Functions at Group Means (Showing the Relationship of Each Function to the Career Activity Preferences) of 9,445 Medical Graduates Who Responded to the 1983 Graduation Survey of the Association of American Medical Colleges

Variables/Preferences	Coefficients/Values		
	Function 1	Function 2	Function 3
Discriminating variables			
Federal scholarship	.87	.14	−.13
Private medical school	−.20	.72	−.39
Female	.13	.44	.85
Total debt	−.25	−.10	.30
"Other" minority	.15	.13	−.07
Nonfederal scholarship	−.04	.31	−.36
Married	.02	−.30	.14
Number of dependents	.05	−.04	−.13
Underrepresented minority	−.05	−.12	.05
Career preferences			
Private clinical practice	−.04	−.16	.00
Clinical practice in a hospital or clinic	.11	.24	.32
Clinical practice in a government agency	1.53	.11	−.13
Administration, teaching, research	−.25	−.10	.30

finding that is consistent with the fact that the students who have such plans are more likely to have attended private schools, less likely to have received federal scholarships, and more likely to have received nonfederal scholarships than any other group. Membership in a minority ethnic group (either underrepresented or not), marriage, and the number of dependents were positively associated with plans to be employed by a government agency.

Interpretation of the findings regarding a student's willingness to consider locating in a socioeconomically deprived area is unavoidably subjective. On the 1983 questionnaire this question read, "Would you consider locating in a socioeconomically deprived area?" The meanings of the terms "socioeconomically deprived" and "consider" were left entirely to the student's interpretation. The lack of clarity as to the meaning of responses to this item is illustrated by the consequences of a wording change in the question. In 1984 this item was changed to, "Do you plan to locate in a socioeconomically deprived area?" The percentage who answered "yes" dropped from 60 percent to 17 percent.

A total of 8,251 responses were included in this analysis of location in a socioeconomically deprived area. Seven of the 10 discriminating variables were entered into the equation in the following sequence: underrepresented minority; federal scholarship; female; nonfederal scholarship; private school; other (that is, not underrepresented) minority; and married. Number of dependents, separated/widowed/divorced, and total educational indebtedness failed to meet the minimum statistical criteria for inclusion in the equation.

Receipt of a federal scholarship proved to have a greater standardized canonical discriminant function coefficient than being a member of an underrepresented minority, despite the fact that the latter variable was entered into the equation first. The standardized discriminant function coefficients from this analysis of a willingness to consider locating in a deprived area were: for federal scholarship, .62; for underrepresented minority, .54; for female, .37; for nonfederal scholarship, .35; for private school, −.33; for "other" minority, .16; and for married, −.08.

The authors consider it remarkable, in view of the small percentage of underrepresented minority respondents to the 1983 graduation survey, that membership in an underrepresented minority group was such a powerful predictor of willingness to locate in a socioeconomically deprived area. It is also noteworthy that, based on the outcome of this analysis, indebtedness evidently played no discernible role in determining whether the students would consider locating in a deprived area after completing training.

Being a woman and having received a nonfederally sponsored scholarship to medical school were moderately associated with a willingness to consider locating in a deprived area, while attendance at a private school was moderately associated with an unwillingness to consider it. Membership in a nonunderrepresented minority group and being married were relatively weak discriminators: the former was positively and the latter negatively associated with willingness to locate in a deprived area.

Discussion

The inflation-adjusted average educational indebtedness of medical school graduates has been increasing for a number of years. This increase has raised concerns that indebtedness could become a

primary determinant of medical students' plans for specialty certification, practice location, and type of practice. The fear has been that newly graduated physicians' educational debts might force them to make career choices at odds with policymakers' efforts to alleviate or prevent shortages of primary care physicians, particularly in underserved and economically depressed areas.

Receipt of a federal scholarship affects a medical student's career plans in unique ways. The scholarship's service requirements dictate the course of the new physician's career at least for the first few years following graduation. At the same time, the scholarship greatly alleviates the financial burden of attending medical school. The situation of federal scholarship recipients thus differs significantly from that of other medical students with respect to indebtedness and career plans.

The findings of the present study suggest that, at least for the class graduating in 1983, other variables are more powerful than indebtedness as predictors of medical students' career choices. Whether or not the student received a federally sponsored scholarship to medical school was the most powerful predictor of career plans.

However, this study did not find the influence of indebtedness on medical student career plans to be nonexistent. Among the 1983 medical school graduates, high indebtedness was associated with a tendency to choose nonprimary care specialties and to plan a career in teaching, research, or administration rather than in clinical practice. The findings suggest that indebtedness had little or no effect on these students' willingness to consider locating in a socioeconomically deprived area.

The 1983 graduating class attended medical school during the peak years of the National Health Service Corps Scholarship Program. As such programs decline and as medical students are forced to rely increasingly on market-rate loans as their main source of financial assistance, the concomitant problems of rising indebtedness, interest capitalization, and repayment may increase the proportion of students who select nonprimary care specialties. If these developments reduce the number of minority students who are able to attend medical school, progress toward the alleviation of physician shortages in economically depressed areas could also be slowed or reversed.

The full effects of heavier borrowing at higher interest rates should become apparent with the 1986 and 1987 graduating classes. Important questions in at least two broad categories have thus far gone largely unaddressed in the literature. The first of these categories is the influence of family economic background on students' propensity to borrow and on their career expectations. Students from affluent families may be more concerned about the tax deductibility of the interest and less concerned about the difficulty of repaying loans than those from less affluent backgrounds. Nor has the literature revealed much about the effects of general market conditions on these processes. Judging by medical students' willingness to incur large debts, many evidently continue to believe they will be entering a "seller's market" for physician services. The research reported to date provides little data about possible changes in this perception or about the effects of such recent events as dropping interest rates and tax reform.

Future multivariate analyses of the kind reported should be performed separately for federal scholarship recipients and nonrecipients. These analyses would help to clarify further the ways in which

changing financial circumstances influence medical students' thinking about their careers.

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DATAGRAM

Reapplicants to U.S. Medical Schools, 1983 Through 1986

Although most applicants to medical school in a given year are applying for the first time, a substantial number are reapplying after an unsuccessful attempt in a previous year. Since these reapplicants are in general less successful than first-time applicants in gaining admission, the overall statistics covering both kinds of applicants that are published in the annual editions of *Medical School Admission Requirements* (1) and the annual education issues of the *Journal of the American Medical Association* (2) may portray a bleaker picture of the difficulty of gaining entry to medical school than is warranted.

Repeat applicants are important to the applications process, because they represent a reservoir of prospective students who augment the pool of individuals making the normal progression from baccalaureate programs. As the number of applicants declines, the percentages of both first-time applicants and reapplicants who are accepted increase.

Until recently, good statistical information on reapplicants was difficult to derive because it required combining information collected in several application years. However, since the completion of the Student and Applicant Information Management System of the Association of American Medical Colleges (AAMC) in 1973, collated data on all applicants to U.S. medical schools have been available. The report presented here includes information on applicants for the entering classes of 1983 through 1986 but takes into account previous applications since 1980. A previous datagram presented data on reapplicants 1981–1984 (3), and less complete information on reapplicants for earlier years was included in prior AAMC publications (4, 5).

Method

For each application year, a previously unsuccessful applicant was defined as an individual who had also applied in one or more of the preceding three years. Although this approach may have resulted in identifying as a first-time applicant the rare individual who may have applied again after a hiatus of more than three years, it allowed consistent treatment of each of the four application years in the study. Thus, for example, for 1983 a previously unsuccessful applicant was one who had applied at least once in the years 1980 through 1982 and again in 1983; and for 1986 a previously unsuccessful applicant was one who had applied at least once in 1983 through 1985 and again in 1986.

The previously unsuccessful applicants were further subdivided into those who applied in only one prior year and those with several prior applications. The group of those who had applied in one prior year was further subdivided into those applying in the previous year only and those applying in an earlier single year.

Previously matriculated applicants were the small number of applicants each year who had attended medical school during the previous three years but had dropped out or had been dismissed. Previously accepted applicants were those who had received an acceptance in one of the previous three years but had not matriculated.

The remainder of the students, that is, those who had no record of an application within three years, were considered first-time applicants. All of the categories are mutually exclusive; thus, the sum of the numbers of applicants, accepted students, or matriculants in all the categories is equal to the number of all applicants, all accepted students, or all matriculants, respectively. The percentage accepted in each category is the number of applicants who were accepted divided by the number of applicants, and the percentage matriculated is the number who matriculated divided by the number of applicants.

Results and Discussion

As shown in Table 1, the aggregate number of applicants declined appreciably, and the aggregate number of accepted students and ma-

TABLE 1

Numbers and Percentages of Applicants to U.S. Medical Schools, by Application Status, 1983 Through 1986

Applicants' Status	1983		1984		1985		1986	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent
First-time applicants								
Applied	25,317	100.0	26,059	100.0	23,517	100.0	23,141	100.0
Accepted	13,444	53.1	13,520	51.9	13,298	56.5	13,310	57.5
Matriculated	12,878	50.9	12,927	49.6	12,567	53.4	12,558	54.3
Previously unsuccessful applicants								
One prior application								
In year prior								
Applied	5,178	100.0	5,341	100.0	5,172	100.0	4,025	100.0
Accepted	2,065	39.9	2,082	39.0	2,273	43.9	1,891	47.0
Matriculated	1,999	38.6	1,997	37.4	2,168	41.9	1,817	45.1
In other year								
Applied	1,678	100.0	1,593	100.0	1,474	100.0	1,583	100.0
Accepted	516	30.7	460	28.9	489	33.2	638	40.3
Matriculated	493	29.4	441	27.7	463	31.4	611	38.6
Two or three prior applications								
Applied	2,284	100.0	2,199	100.0	2,005	100.0	1,704	100.0
Accepted	765	33.5	716	32.6	726	36.2	681	40.0
Matriculated	742	32.5	686	31.2	699	34.9	658	38.6
Previously accepted applicants								
Applied	434	100.0	446	100.0	484	100.0	590	100.0
Accepted	388	89.4	388	87.0	410	84.7	530	89.8
Matriculated	351	80.9	328	73.5	345	71.3	437	74.1
Previously matriculated applicants								
Applied	309	100.0	306	100.0	267	100.0	280	100.0
Accepted	31	10.0	28	9.1	32	12.0	42	15.0
Matriculated	17	5.5	16	5.2	26	9.7	22	7.9
All applicants								
Applied	35,200	100.0	35,944	100.0	32,893	100.0	31,323	100.0
Accepted	17,209	48.9	17,194	47.8	17,228	52.4	17,092	54.6
Matriculated	16,480	46.8	16,395	45.6	16,268	49.5	16,103	51.4

triculants declined very slightly over the three-year period ending in 1986. The number of applicants declined by 8.6 percent, the number accepted by 1.0 percent, and the number matriculated by 2.5 percent. The overall probability of being accepted ranged between 47.8 and 54.6 percent during 1983–1986.

First-time applicants were 73.9 percent of all applicants in 1986 but were 78.0 percent of matriculants. The proportion of first-time applicants accepted in 1986 was 57.5 percent, which was substantially higher than for any of the groups of previously unsuccessful applicants.

In 1986, 47.0 percent of the individuals who applied for the second consecutive year were accepted, while only 40.3 percent of those who applied for the second time after a hiatus were accepted.

More than 1,700 of the applicants who applied in 1986 were doing so for at least the third time. These individuals had a considerably lower chance of success than first-time applicants, but more than one-third of them were eventually accepted and matriculated.

The previously accepted group had an acceptance rate in 1986 of 89.8 percent, which is higher than that of any of the other groups reported. However, many of these individuals had been granted deferred matriculation by the school that originally accepted them. The author has not analyzed the data to separate those previously accepted at the same school from those previously accepted at another school or to separate those already accepted in the previous year from those accepted in an earlier year. This group of previously accepted applicants is small but definitely growing, rising from 434 in 1983 to 590 in 1986. Of the individuals accepted from this group in 1986, 17.5 percent did not matriculate; in contrast less than 6 percent of accepted first-time applicants that year failed to matriculate.

The previously matriculated applicants were unlikely to gain a second chance at medical education. Only 15.0 percent were accepted in 1986, and only 7.9 percent matriculated.

The percentage accepted and percentage matriculated increased appreciably over the three-year period for all groups except the previously accepted applicants, where the percentages were already very high. Changes observed for the period 1983–1986 were greater than changes found in the prior analysis for the period 1981–1984 (3).

To summarize, almost three quarters of all applicants in any given year are first-time applicants. Reapplicants have a smaller but still good chance of acceptance. The probability of acceptance is increasing as the numbers of applicants of almost all types decline.

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